Morgan Lewis

Timothy L. Bransford
Partner
+1.202.373.6140
timothy.bransford@morganlewis.com

March 7, 2019

Via ECFS

Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Re: ***Notice of Ex Parte Communication - IB Docket No. 18-313, Mitigation of Orbital Debris in the New Space Age***

Dear Ms. Dortch:

On March 5, 2019, Andrew Long, Chief Executive Officer, and Robert Feconda, Chief Operating Officer of Keplerian Technologies Inc. (KTi), along with outside counsel, Tim Bransford, met with William Davenport, Legal Advisor to Commissioner Geoffrey Starks to provide background on the company's automated space object identification solutions and discuss the orbital debris proceeding referenced above.

KTi described its innovative space beacon technology that dramatically improves the ability to track space objects from the ground, and its mission to effectively provide a "black box" for space objects. The company emphasized that it supports the Commission's desire to update and realign orbital debris rules to better address a more crowded and dynamic space environment given the proliferation of small satellites and commensurately heightened orbital debris risk in the "new space" era.

The parties also discussed why situational awareness in space is critical for maintaining the utility of heavily trafficked low-earth orbits, and potential solutions for improving situational awareness in the future under revised orbital debris rules.

A copy of the written presentation materials used in the meeting is attached hereto. To the extent you have questions or concerns, please feel free to contact the undersigned.

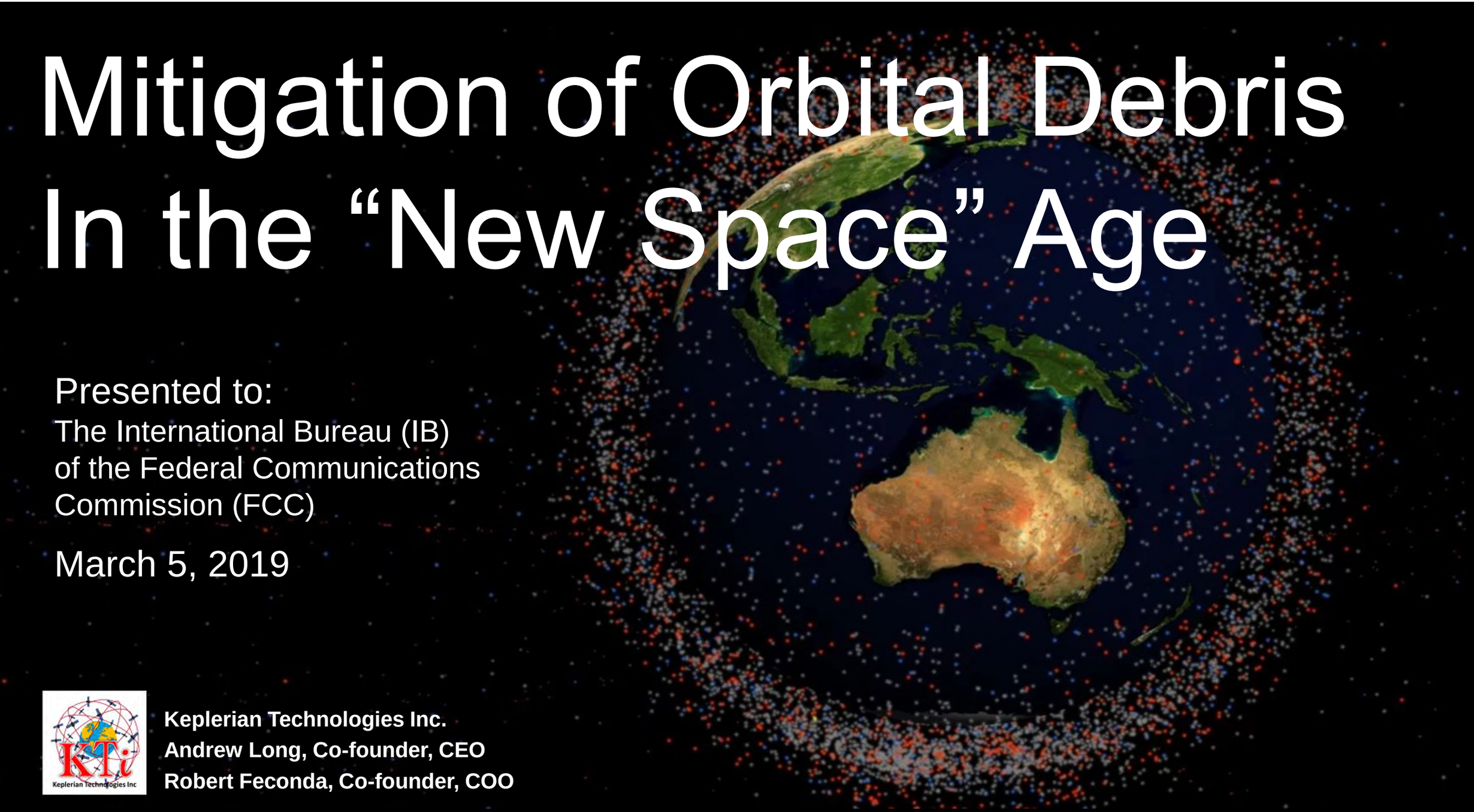
Very truly yours,

/s/

Timothy Bransford
Counsel for Keplerian Technologies Inc.

cc (via email): William Davenport

Mitigation of Orbital Debris In the “New Space” Age



Presented to:
The International Bureau (IB)
of the Federal Communications
Commission (FCC)

March 5, 2019

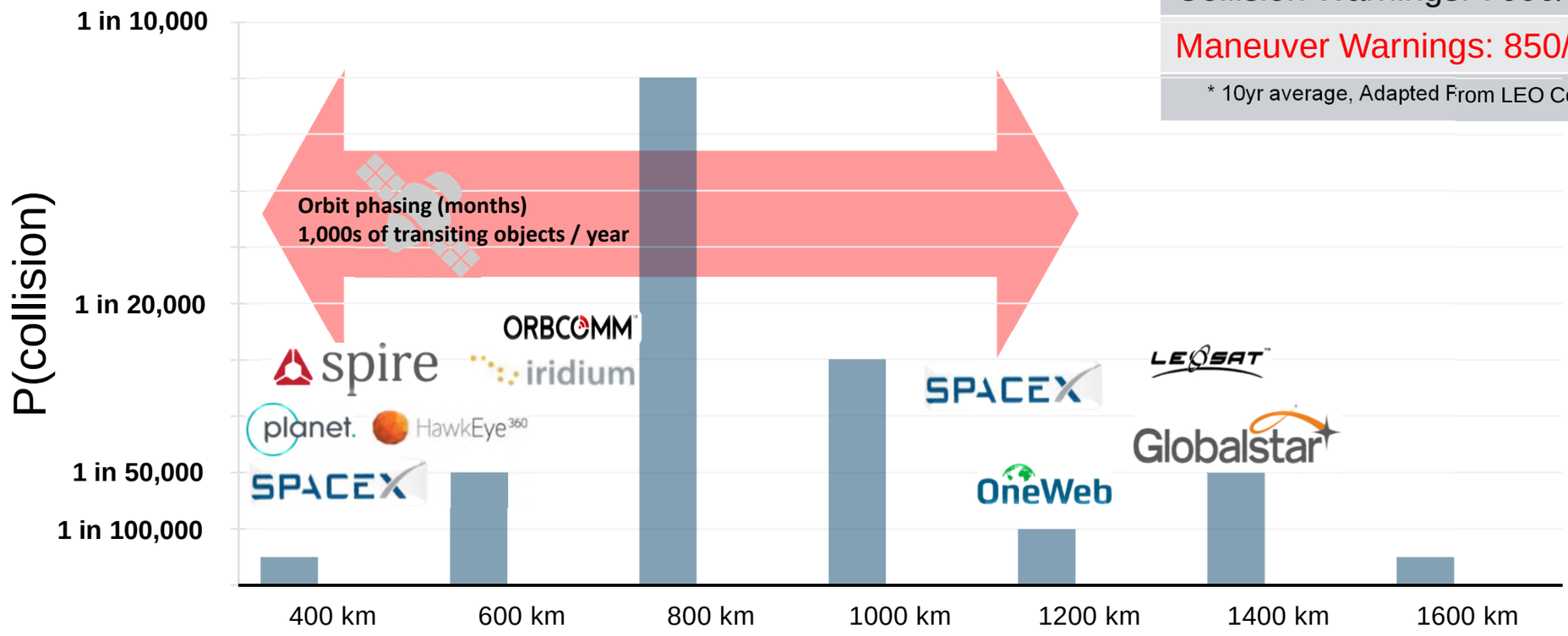
Keplerian Technologies Inc.
Andrew Long, Co-founder, CEO
Robert Feconda, Co-founder, COO

Orbital Debris Presents Immediate Threat to “New Space” Industry

- $323B Global space economy facing a growing man-made asteroid belt
- Potential for catastrophic collisions + cascading debris
  - Exponential growth in spacecraft conjunction warnings
- All constellations potentially impacted
  - Billions in vehicle losses & service interruption
  - Collision avoidance operational burdens
  - Orbits rendered unusable/unpassable
- Challenges
  - Timely situational awareness of the environment
  - Explosion of new operators / no standards
  - Preference for private sector fix to problem
  - Current solutions use traditional approaches

Dynamic and Evolving Low Earth Orbit Commercial Market

Potential Mission Impact*
Collision Warnings: 7600/week
Maneuver Warnings: 850/week
* 10yr average, Adapted From LEO Collison Risk – AGI 2017



$Billions of New Space Investment at Risk of Collision

Revisiting FCC Orbital Debris Rules Urgently Needed

2004 “Old Space”

Market dominated by big geostationary satellites

- Direct Broadcast: XM, Sirius, Direct TV
- Fixed Services: Transponder
- Mobile Services: Emergency response & military

Large aerospace manufacturers / launch providers

- Single spacecraft > $100M
- $10-100M per launch

Big barriers to entry

Stable, known environment

Low Collision Risk

2019 “New Space”

Market dominated by proliferated remote sensing, data products, and internet-focused services

- Remote Sensing/ Data: Worldview, Planet, Spire, HawkEye360
- Internet Services: OneWeb, SpaceX

Dozens of low cost manufacturers and launch vehicle providers

- Over 170 start-ups w/ $15B in financing
- Some smallsats < $100K

Innovation & Investment

Dynamic environment

Increasing Collision Risk

A Real-World Problem in 2019

Three (3) in-orbit collisions since 2009

- 2009: Iridium 33 & Russian Kosmos 2251
- 2013: Fengyun FY-1C debris (ASAT test) & Russian BLITS nano-satellite
- 2013: Two cubesats, Ecuador's Pegaso, Argentina's CubeBug-1, and Tsyklon-3 upper stage

Over 1,000 smallsats launched between 2012 - 2017

- 6x smallsats in 2017 compared to 2012
- 2017 saw record 104 satellites at once!
- “Mega-constellations” began to enter the market in 2018-19

2019: Already one widely published “close call”

- U.S.-flagged Denali observation satellite executed emergency maneuver
- Clear gaps in existing satellite tracking and collision avoidance approaches

Many small satellites lack real-time tracking and maneuvering

- Collision avoidance becomes a dangerous guessing game without real-time data collision avoidance game

illustration of 73 smallsats from Soyuz Fregat upper stage July 14, 2017 Credit: Glavkosmos

One collision in heavily trafficked LEO altitudes will dramatically increase the debris field

Solution: Active Space Beacons

Our mission: Provide automated space object identification, tracking and monitoring ("Black Box" for space objects)

Explicit identification with hosted Radio Frequency (RF) beacon

Independent of space object size/quantity or proximity

Small form factor enables proliferation (Cubesats, SmallSats, UpperStages, etc.)

Self-powered allowing operation during and after space object life

Built-in sensors support anomaly resolution (e.g. acceleration, rotation)

Responsive to International Guidelines

- UN COPUOS long-term sustainability of outer space activities. A/AC.105/C.1/2018/CRP.18/Rev.1
  Guideline 30 encourages member states to: "Promote design approaches that increase the trackability of space objects"
- UN - Inter-Agency Space Debris Coordination Committee (IADC)
  IADC-15-03 recommends enhance trackability by adding onboard active and/or passive components.

Commission's Notice Seeks Comment on Important Issues

Para. 36-38 Tracking and Data

- Cooperative tracking with explicit identification independent of main spacecraft systems should be required ("Black Box")
- Hardware solutions are under development and will be fully qualified for flight in 2019

Para. 58-59 Post-Mission Lifetime

- Continued tracking and data sharing during post-mission lifetime (or in event of failure) should be required

Para. 72-73 Retention of Ephemeris Data

- Data rights for the tracking data need to be considered for commercial services in this area
- Any data transparency requirement should be limited to satellite state (3D Position and Velocity)
    - Consistent with Airborne (ADS-B) and Maritime (AIS) communities

Para. 76-81 Liability Issues

- Requiring space beacons positively supports space operators should 3rd party litigation occur
- Shows "best practices" in place and operator has gone "above and beyond" to avoid collision

Para. 80 Non-U.S.-Licensed Satellites

- Non-U.S.-licensed satellites seeking U.S. market access should be subject to new / amended rules

Para. 95 Use of Economic Incentives

- Requiring on-orbit / re-entry liability insurance would incentivize operators to reduce debris / collision risk

Why Space Beacons: Promotes “Good Stewards of Space”

Reporting / Transparency:

Rapid identification, orbit determination, and notification of your satellite/upper stage upon deployment

Continue to report your satellite’s/stage’s position after useful life or in the event of unexpected outages

Active Measures to Sustain Space Environment

Enhance Trackability in line with Sept 2017 IADC LEO constellation trackability recommendation

Provide optional de-orbit service via beacon-triggered drag device

Space “Norms of Behavior”

Contribute to the development and establishment of space operating “Norms of Behavior”

Help set standards of “Good vs Bad” operational behavior

Space Beacons Encourage, Facilitate, and Promote the Uninterrupted and Free Flow of Commerce in Orbital Space

Space Beacons as a Secondary Service Supporting Debris Mitigation

Space beacons can be integrated as a secondary service further aiding debris mitigation

Enhanced Satellite Servicing: RF fiducial (i.e. range/rotation) within spacecraft capture feature

Active Debris-Removal: De-orbit device triggering on inoperable spacecraft

Near Real-time Space Environmental Monitoring: Enhanced de-orbit modeling predictions/drag models

Exploring several opportunities to operate on limited / experimental basis

Near-term opportunity to deploy with secondary services on approx. 500 LEO COMSATs (Mega-constellation)

Government-sponsored opportunity for a commercial multi-satellite demonstration mission

Amateur / University cubesats: Technology demonstration

Desire to operate space beacons in an experimental mode;
Transition to other frequency / mode in future if needed